Prices and Monetary Policy in Emerging Markets: A FAVAR Approach to Disaggregated Chinese and Indian Data

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This paper follows the Boivin, Giannoni, and Mihov (2009) framework to examine price behavior and effects of monetary policy in the two largest emerging markets in Asia: China and India. By adopting the factor-augmented vector autoregressive (FAVAR) model, we study the fluctuations of aggregate and disaggregated price series resulted from macroeconomic and sector-specific shocks. It is found that sources of fluctuations in aggregate price differ in China and India. For China, most of the price fluctuations come from common macroeconomic shocks. In contrast, in India, they arise from sector-specific disturbances. The level of inflation persistence in China and India likewise differs. In China, fluctuations in aggregate price series are more persistent than those in disaggregated prices. In India, however, inflation persistence is weak in both aggregate and disaggregated price series. Nevertheless, a noteworthy phenomenon commonly shared by both countries is that under an unexpected sector-specific shock, rural prices react more drastically than urban prices.

This thesis also shows that the FAVAR framework greatly improves impulse response forecast as compared to standard vector autoregressions (VARs). In addition, the empirical results suggest that the McCallum-type monetary rule fits the Chinese setting, while the Taylor-type monetary rule would be more suitable in describing the effects of monetary policy in India.

論文摘要

本論文採用 Boivin， Giannoni，和 Mihov (2009) 的方法來觀察中國和印度，兩個亞洲最大的新興市場的價格行為和其貨幣政策的影響。通過運用 Factor-augmented vector autoregressive （FAVAR）模型，我們可以了解到整體價格和各行業價格波動的原因，了解這些波動是源於宏觀經濟的衝擊還是各個行業的衝擊。這篇論文發現，中國和印度的整體價格波動原因是不同的。在中國，大多數的整體價格波動來源於宏觀經濟的衝擊。然而在印度，他們源於各個行業的震動。另一方面，中國和印度的價格波動持續時間也不同。在中國，整體價格波動的持續時間要長於各行業價格的波動。然而在印度，整體價格和行業價格的波動持續時間都比較短。無論如何，中國和印度有一個共通的顯著現象，當面對意外的行業衝擊，農村的價格波動比城市的價格波動更劇烈、明顯。

這篇論文同時也發現，和舊有的 VAR 模型相比,新的 FAVAR 模型可以極大地提升衝擊反應（impulse response）的預測。而且，研究也發現在中國，McCallum 這一類型的貨幣規則更適用於中國的數據；而 Taylor 這一類型的貨幣規則更適用于研究印度其貨幣政策的影響。

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Chapter 1 Introduction

Whether prices are sticky has been a subject of debate for many years. For example, Christiano, Eichenbaum, and Evans (1999) provide evidence that aggregate prices series are sticky. Bils and Klenow (2004), however, suggest the opposite by using sectoral prices. Conventional studies including Bernanke and Blinder (1992), Sims (1992), and Boivin and Giannoni (2002) use the VAR approach to study price fluctuations. However, these conventional VAR models either include only a limited number of variables or impose "incredible identification" assumptions. Boivin, Giannoni, and Mihov (2009) (hereinafter referred to as BGM) use the factor-augmented vector autoregressive (FAVAR) model to examine both aggregate and disaggregated price series in the United States. Unlike the standard or structural VARs, the FAVAR model is able to incorporate a large set of macroeconomic indicators into the VAR system using factor analysis.

The FAVAR model can disentangle the price fluctuations into two sources: common macroeconomic factors and sector-specific conditions. It pays special attention to monetary policy instruments and their effects on the economy. The BGM paper shows that disaggregated prices are generally more volatile than aggregate price series. Specifically, disaggregated prices appear sticky in response to macroeconomic and monetary policy disturbances, but are flexible to sector-specific shocks. Therefore, models with a sticky price setting are more successful in describing the volatility and persistence of inflation caused by macroeconomic and monetary disturbances. BGM (2009) also shows that the FAVAR model significantly improves impulse response forecasts and that the long-run non-neutrality of money and "price puzzle" disappear after adopting the FAVAR framework.

Whether or not the results of BGM (2009) apply to emerging countries is an important issue yet to be addressed. A special feature associated with emerging countries is the existence of urban and rural price difference. In this thesis, we apply the FAVAR framework to two major emerging markets, China and India, to study the responses of aggregate and disaggregated prices to each type of shocks. In addition, this study extends the BGM paper by taking into consideration some characteristics unique to emerging markets. We examine the differences in urban and rural price behavior when facing shocks, and evaluate if either the Taylor-type or McCallum-type[1] monetary policy rule would better fit the data in these two countries.

The rest of the thesis is organized as follows: Chapter 2 presents some background information and reviews the literature on sticky price and monetary policy. Chapter 3 discusses the empirical framework and data sources. Chapter 4 presents empirical results on sources of price fluctuations and persistence. Chapter 5 documents the effects of monetary policy shocks in China and India. Chapter 6 briefly concludes the thesis.

Chapter 2 Literature Review and Background

2.1 The literature on price stickiness

The standard VAR approach[2] generally finds price stickiness in aggregate price series. For example, Christiano, Eichenbaum, and Evans (1999) provide evidence that following a monetary policy shock, aggregate prices remain unchanged for 1.5

[1] According to Razzak (2001), the Taylor-type rule is essentially the response of bank rate to the deviation of the inflation rate from a desired target and to the output gap (deviation of real GDP from its potential). The McCallum-type rule is the response of money base growth rate to the deviation of the nominal GDP growth rate from a desired target value.

[2] The identification of these standard VARs usually involves a wide range of identifying assumptions.

years. Other studies on wholesale or retail items, such as MacDonald and Aaronson (2001) and Kackmeister (2007), also show that price stickiness lasts for at least several months before they begin to adjust. Many macroeconomic models therefore are built on the assumption that prices are sticky.

Recent literature on disaggregated price series suggests that sectoral prices are very much volatile. Bils and Klenow (2004) examine the price change of 350 consumer goods and services. It is found that the average waiting time prior to a price change is 4.3 months, which is much less than that of the aggregate price series. A more recent paper by Klenow and Kryvtsov (2008) shows that the average waiting time after adjustments in sale prices can be as long as 7.2 months.[3] The BGM paper studies both the aggregate and disaggregated prices, and shows that the aggregate price series are much stickier than sectoral price series. However, most of the volatility of disaggregated prices comes from sector-specific shocks, explaining about 85% of the total variation.

2.2 The literature on monetary policy

China and India have undergone substantial reforms in their monetary policy regime since the 1990s. China does not have a target interest rate, and its loans and deposits rates remain largely administratively determined. The People's Bank of China (PBC) adopts a broad money supply (M2) target to hold up a pro-growth agenda; only since very recently has it started changing the fixed exchange rate regime. Lardy (2005) criticizes this "monetary expansion for economic growth" policy because it leads to the so-called hard landing problem in the economy and hinders China from transforming itself to a flexible exchange rate regime. As pointed out by Zhang (2006), China depends heavily on capital controls to maintain

[3] This is still less than the aggregate price series would imply.

a fixed exchange rate system, but this procedure proves to be unsustainable. Kramer, Poirson, and Prasad (2008) suggest that the room to regulate capital flows effectively through capital controls diminishes as financial globalization continues.[4]

In contrast, India adopts a market-determined exchange rate system in March 1993. The Reserve Bank of India (RBI) gives up a variety of administered interventions in interest rates during the 1990s. The dissemination of information on overnight rates and volumes drastically enhances the efficiency and transparency of its monetary policies. For an overview of the post-1990 monetary landscape in China and India, one is referred to Burdekin and Siklos (2008) and Mohan (2006).

In this thesis, we choose M2 as the monetary policy instrument for China; for India, we adopt the bank rate of RBI. This thesis also uses PBC's base rate and RBI's M3 growth rate[5] for monetary policy analysis in China and India, respectively, in order to examine whether the Taylor-type or McCallum-type rule could better describe the data.

Chapter 3 Model and Data

3.1 The model

The empirical model that we consider in this thesis is a factor-augmented vector autoregressive (FAVAR) model. Unlike the standard VAR or structural VAR models, which can only include a limited amount of variables, the FAVAR model is able to incorporate a large set of macroeconomic indicators. Utilizing this information set in the estimation of our empirical model leads to a better

[4] China continues to use capital controls to regulate capital flows even though capital controls, especially capital outflow in China have relaxed gradually in recent years (see Zhang, 2006).

[5] It is better to use M0, but this series contains substantial missing values. In India, reserve money M0 induces broad money M3 through a "money multiplier". Therefore, we use M3 as the monetary instrument in this thesis.

identification of the monetary policy shocks compared to the ordinary VARs or structural VARs. We adopt a principal component approach in this thesis, which is similar to the one used by Bernanke, Boivin, and Eliasz (2005) (hereinafter referred to as BBE) and the BGM paper. [6] There are two major equations: (1) an observation equation, wherein we apply factor analysis, and (2) a transition equation, which is similar to the one used in a standard VAR.

(1) $$X_t = \Lambda C_t + e_t$$

where $$C_t = \begin{bmatrix} F_t \\ R_t \end{bmatrix}$$

(2) $$C_t = \Phi(L) C_{t-1} + v_t$$

X_t is an Nx1 vector of macroeconomic indicators where N is supposed to be large. C_t is a (K+1)x1 vector of common components comprising two parts: a Kx1 vector of latent factors F_t, which is obtained through a principal component analysis on X_t, and the second part, a monetary policy instrument R_t. Since F_t is the latent factor representation of X_t, K is relatively smaller than N, i.e., N >> K+1. These latent factors summarize the information contained in X_t, reflecting notions of "general economic condition" or "economic activity". Λ is an Nx(K+1) matrix of factor loadings. e_t is an Nx1 vector of series-specific component, which is uncorrelated to the common component C_t. These series-specific components are allowed to be serially correlated and weakly correlated across variables.

[6] The BBE study adds two other major advantages to the FAVAR framework. First, by adopting the FAVAR model, it would be unnecessary to "take a stand on the appropriate measures of prices and real activity." Second, standard VARs can obtain impulse responses for the included variables only, which merely represent a small subset of the variables of interest. For instance, one may be interested in the effects of monetary policy shocks on productivity, economic growth, wages, and investment activity; however, inclusion of extra variables is severely limited by the degrees-of-freedom problem in ordinary VARs. The FAVAR framework can conveniently avoid the abovementioned problems.

Equation (2) is a standard VAR system in C_t, where $\Phi(L)$ is a conformable lag matrix, which may contain a priori restrictions. Similar to standard VARs, the error term v_t is assumed to be i.i.d. with zero mean and constant finite variance.

3.2 Model estimation

Following the BBE and BGM models, we estimate the empirical model using a two-step principal component approach. In the first step, we extract latent common factors from a large set of macroeconomic indicators by using principal component analysis.[7] In the second step, we append the monetary policy instrument R_t to the estimated factors F_t to form a common component vector C_t. To guarantee that the estimated latent factors F_t are independent of R_t, we adopt an iteration algorithm to exclude the effects of R_t from X_t.[8]

This two-step estimation approach is semi-parametric. It does not impose distributional assumptions on the observation equation. It is computationally efficient and easy to implement.[9] However, in the second step of the two-step estimation method, there is an "uncertainty problem" brought about by the generated regressors $\hat{F}_t$. In order to obtain reliable confidence intervals on the

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[7] According to Stock and Watson (2002), the principal component method can consistently recover the space spanned by the factors when N is large. It requires only a small number of principal components to account for much of the variance of macroeconomic data series.

[8] This is also the algorithm adopted by BGM: (1) start from an initial estimated $F_t^{(0)}$, which is obtained from the first K principal components of X_t; (2) regress X_t on $F_t^{(0)}$ and R_t to obtain $\hat{\lambda}_R^{(0)}$; (3) compute $\hat{X}_t^{(0)} = X_t - \hat{\lambda}_R^{(0)} R_t$; (4) estimate $F_t^{(1)}$ as the first K principal components of $\hat{X}_t^{(0)}$; (5) repeat (2) –(4) multiple times.

[9] The BBE study shows an alternative one-step estimation method. They use the Bayesian likelihood method and Gibbs sampling to estimate the factors and the dynamics simultaneously. However, while the advantage of this one-step approach is modest, calculation is cumbersome. The likelihood-based method is fully parametric, and thus may imply different biases and variances depending on how well the model is specified.

impulse response functions, we use a bootstrap procedure introduced by Kilian (1998) to address the uncertainty brought by factor estimation.[10]

3.3 Data

The data set used to estimate the FAVAR model is a balanced panel for China and India.[11] All data series come from CEIC and IMF database, and are adjusted for stationarity. The data set consists of two parts. The first part is a large set of observable macroeconomic indicators, such as industrial output, employment, foreign trade to banking statistics, stock market price indexes, and exchange rate. The second part is the disaggregated price series, or the price index from each sector of the economy. In the CEIC database, there are disaggregated producer price index (PPI) for China and disaggregated wholesale price index (WPI) for India. A detailed list of how each data series is transformed is available in the Appendix.

The data set for China is monthly based and ranges from 2001 M2 to 2008 M12 (T=95), with 156 macroeconomic indicators and 36 disaggregated price series (N=156+36=192). The data set for India is also monthly based and ranges from 1996 M6 to 2008 M10 (T=149), with 72 macroeconomic indicators and 59 disaggregated price series (N=72+59=131).

Chapter 4 Price Fluctuations in Disaggregated Data

Similar to the BGM paper, we derive the following equation from (1) and (2) of Chapter 3.1 to investigate the sources of fluctuations in disaggregated price series:

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[10] According to Bai and Ng (2004), when N is large relative to T, the uncertainty problem of the estimated factors can be ignored. The bootstrap procedure we adopt here is the same as the ones in BBE and BGM.

[11] China and India are selected because they are the two largest emerging countries in Asia and because of data availability. A lot of other emerging markets do not have disaggregated price series for each segment of the economy.

(3) $$\pi_{it} = \lambda_i' C_t + e_{it}$$

where π_{it} is the log difference of monthly price series. This may include prices from each sector of the economy (i.e., sectoral inflation rate) or the aggregate price index (i.e., overall inflation rate). Equation (3) allows us to disentangle price series fluctuations into two parts: those due to macroeconomic disturbances (C_t) and those from sector-specific conditions (e_{it}). Equation (3) also allows us to examine how much of the persistence in sectoral price change can be attributed to macroeconomic factors or sector-specific conditions. Note that while the common component C_t is the same for different sectoral inflation rates, the factor loadings λ_i is sector-specific.

4.1 Sources of fluctuations and persistence in price series

To obtain equation (3) for volatility and persistence analysis, we estimate systems (1) and (2) using three latent factors for both China and India in equation (1), two lags in equation (2) for China, and four lags in equation (2) for India.[12]

4.1.1 China inflation volatility

For China, as shown in Table 1, the volatility of the monthly aggregate price series is 0.87%. It is higher for prices in the heavy industry and producer goods sectors, ranging from 1.1% to 1.43%. For prices in the consumer goods and light industry, the volatility is much smaller at 0.33% to 0.35%. Most of the aggregate price fluctuations result from common macroeconomic factors. The R-square for common components is 77%.

[12] The decision on the number of lags used is based on the lag length test. The reason for choosing three latent factors is that the variance of the fourth factor drops dramatically compared to the first three. Considering the degrees-of-freedom problem of VARs in (2), we decide to proceed with three latent factors.

The volatility of sectoral price is higher than in an aggregate price series. The average volatility of the 36 included sectors is 1.3%, with the largest 7.66% in the sector of petroleum and natural gas production; the smallest is 0.35% in the sector of beverage manufacturing. In contrast to aggregate price series, most of the fluctuations in sectoral prices come from sector-specific disturbances, with an R-square of 73%. This price volatility feature of China is similar to that of the United States: large fluctuations in sectoral prices series tend to cancel each other out, which leads to a less volatile aggregate price index.

Insert Table 1 here

Insert Table 2 here

It is worth noting that the common component volatility is strongly positively correlated to sector-specific volatility across different sectors. From Table 2, the correlation between Sd($\lambda_i' C$) and Sd(e_i) is 0.94. This may be due to the fact that if some sectors adjust swiftly to idiosyncratic shocks, then these sectors also have the ability to adjust promptly to macroeconomic shocks.

Note that sectoral disturbance e_i not only includes sector-specific shocks, but also measurement errors in each sectoral price series. However, as pointed out in BGM (2009), this should not affect the estimated effects of common components and the aggregate price series. Besides, from the strong positive correlation (0.94) between common component volatility and sector-specific volatility, e_i should contain more than just sampling errors; otherwise, we would expect a much lower correlation.

4.1.2 China inflation persistence

The degree of persistence for π_{it}, $\lambda_i' C_t$, and e_{it} is calculated by adding up the coefficients of all the AR lags. Consistent with our expectation, fluctuations in the aggregate price series are more persistent than in the disaggregated price series: 0.62 as opposed to 0.22 (see Table 1). Therefore, sectoral inflation rates are generally more volatile and less persistent than aggregate inflation rate. This is similar to the results of BGM (2009) and Clark (2003) for the US, and Altissimo, Mojon, and Zaffaroni (2007) for Europe. We also notice that common macroeconomic inflation is more persistent than sector-specific inflation.

In line with Bils and Klenow (2004), there is a weak positive correlation between price series volatility and persistence in both sectoral inflation and common macroeconomic inflation: a correlation of 0.22 between Sd($\lambda_i' C$) and ρ($\lambda_i' C$), and a correlation of 0.2 between Sd(e_i) and ρ (e_i). This empirical finding is a contradiction to the Calvo sticky price model[13], which states that the price volatility should be low and persistence should be high in sectors with highly sticky prices. Thus, there should be a strong negative correlation between sectoral price volatility and sectoral price persistence.

4.1.3 India inflation volatility

Similar to the US and China, the volatility of sectoral prices in India is higher than in the aggregate series (2.2% versus 0.6%). Similar to China, price volatility is higher for primary articles and fuel and power, at 1.31% and 1.77%, respectively.

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[13] Calvo's sticky price model implies that the inflation process follows: $\pi_{it} = (1-\delta_i)\pi_{it-1} + \delta_i \varepsilon_{it}$, where ε_i is the growth rate of marginal cost of good i, and δ_i is the rate of price adjustment. This model implies that when the rate of price adjustment δ_i (volatility) is low, persistence (1- δ_i) is high.

For manufactured goods, price volatility is much lower at 0.47%. The average price volatility of the 59 sectors included is 2.2%, with the largest at 7.64% in non-food primary articles, and the smallest at 0.5% in manufactured transportation equipment for motor vehicles. However, in contrast to China and the US, most of the fluctuations in both aggregate and disaggregated price series are from sector-specific shocks, with an R-square of 65% and 93%, respectively.

Insert Table 3 here

Insert Table 4 here

The correlation between common component volatility and sector-specific volatility is also weaker in India with a correlation of 0.69 (see Table 4), as opposed to 0.81 in the US and 0.94 in China.

4.1.4 India inflation persistence

The picture of inflation persistence in India is also different compared to the US and China. Price persistence is weak in both aggregate and disaggregated price series, at a level of 0.14 for the aggregate series and 0.16 for sectoral series, as seen in Table 3. The same statistics are 0.93 and 0.48 for the US, and 0.62 and 0.22 for China. For the aggregate price series, common component inflation persistence is as weak as the sector-specific inflation. However, for disaggregated price series, common macroeconomic price fluctuation is more persistent than sector-specific price fluctuation (0.35 versus 0.12), as shown in Table 3.

India's price series behavior is, however, consistent with Calvo's sticky price model: a negative correlation between price series volatility and persistence. The correlation between Sd($\lambda_i' C$) and ρ($\lambda_i' C$) is -0.27 and the correlation between Sd(e_i) and $\rho(e_i)$ is -0.23. This implies that for sectors with high degree of price

stickiness, the effects of exogenous shocks are small, which leads to a low price volatility and high persistence.

4.2 Effects of macroeconomic and sector-specific shocks on price

Being able to identify sources of price change and to study their effects on prices are particularly important for policy-makers.[14] Most of the current studies only show that price series respond quickly and strongly to shocks, rather than revealing which type of shocks leads to rapid price adjustments. This chapter is devoted to documenting the effects of sector-specific and macroeconomic shocks on prices, specifically, the response of log sectoral price to one standard deviation drop in e_{it} and $\lambda_i' C_t$.

4.2.1 China sectoral price response to various shocks

The left and middle panels of Figures 1 and 2 document sectoral price response to sector-specific shocks and common macroeconomic component shocks. The solid line reflects the unweighted average of these sectoral price changes.

The left panels in both figures show that disaggregated prices adjust immediately to sector-specific shocks and the effects are short-lived.[15] The price responses to macroeconomic shocks manifest differently. The response of sectoral prices to common component shocks is long-lasting and sluggish for both cases of base rate and M2. They fall only moderately initially, but continue to drop as time

[14] For example, if prices adjust rapidly following a sector-specific shock, then sector-specific disturbances have short-lived effects on the economy. However, if monetary shocks lead to persistent adjustment of prices, then monetary policy will have a long-run impact on the economic activity.

[15] A similar picture can also be obtained from the US data where BGM explains that this phenomenon might be due to the fact that most of the sector-specific shocks are supply-type disturbances, for example, a permanent shock to sector productivity.

evolves. This shows sluggishness and persistence in sectoral prices in response to macroeconomic shocks.

Insert Figure 1 here

Insert Figure 2 here

4.2.2 India sectoral price response to various shocks

The picture for India's sectoral price response to sector-specific and macroeconomic shocks is similar to that of the US and China. In Figures 3 and 4, we observe a short-lived price response to sector-specific disturbances, while the response is sluggish and persistent to macroeconomic shocks. To summarize, sector-specific shocks determine the level of inflation rate, while common component shocks contribute to price volatility.

Insert Figure 3 here

Insert Figure 4 here

A major drawback of the above analysis is that common macroeconomic components are represented by the factors we estimated using the principal component method. These factors are abstract in meaning, and they represent a certain combination of macroeconomic indicators. Therefore, we could not identify the effects of a particular macroeconomic variable on price response. In light of this, we will devote Chapter 5 to the investigation of price response to monetary policy shocks.

4.3 Urban and rural price responses to various shocks

For emerging markets like China and India, it would be interesting to study the differences in rural and urban price response when facing various shocks. However, the literature in this aspect is very limited. The existing studies tend to examine the

rural–urban price behavior in a specific sector instead of analyzing a composite price index. For example, the US Federal Housing Finance Agency reports in 2000 that rural property prices increase more drastically than urban property prices when facing a shock in technological advancement. In this section, we examine the effects of sector-specific shocks, common component shocks, and monetary policy shocks on urban and rural consumer price index (CPI). From Figures 5 and 6, we can see that urban and rural price behaviors in China and India are quite similar. For emerging markets, this implies that there exists a common ground when observing urban and rural price responses to shocks. The sector-specific and common component shocks are one standard deviation of e_{it} and $\lambda_i' C_t$, respectively. The monetary shock is +0.25% change in the central bank's base rate in both countries.

Insert Figure 5 here

Insert Figure 6 here

For both countries, macroeconomic shocks have almost the same impact on urban and rural prices. Monetary policy shocks, as special cases of macroeconomic shocks, generate a similar story. However, when facing sector-specific shocks, urban CPI responds more drastically than rural CPI in China, while the opposite is true in India.

In sum, in both countries, urban and rural CPIs respond similarly to macroeconomic and monetary policy shocks while sector-specific shocks are seen as the main reasons leading to differences in urban–rural inflation dynamics. This finding has policy implications to urban-rural price difference and inequality.

Chapter 5 Effects of Monetary Policy Shocks

Since the pioneering work of Bernanke and Blinder (1992) and Sims (1992), VARs have become popular tools for policy-makers in assessing the effects of monetary policy on macroeconomic variables. However, these conventional VAR models either include a limited amount of variables or impose "incredible identification" assumptions. This chapter studies the effects of monetary policy shocks to various macroeconomic variables in China and India using the new FAVAR method. The FAVAR approach elaborated herein extends the existing literature by increasing the number of variables that we include, as well as imposing minimal identifying restrictions.

5.1 Effects of monetary shocks in China

We compute the impulse response of industrial production and price level when faced with a monetary policy shock. Three models are estimated, including the baseline FAVAR model as proposed in this thesis, the standard VAR, and an "in-between" model composed of a standard VAR plus one latent factor. Monetary shock refers to an unexpected 25 basis points increase in the central bank's base rate and M2 for Figs. 7 and 8, respectively.

Insert Figure 7 here

Insert Figure 8 here

Similar to the case of the US, the FAVAR model seems capable of solving the long-run money non-neutrality problems, commonly present in standard VARs. Regardless of whether the base rate or M2 is the monetary policy instrument, we can see that monetary shocks lead to a permanent impact on industrial output under the VAR and VAR+1 factor models. However, the impulse response generated by

FAVAR shows a return to the original output level at the end of 48 months. This implies that the FAVAR framework is able to utilize the information contained in a large set of macroeconomic indicators to help improve model estimation. The performance of the VAR+1 factor model suggests that the first latent factor does not contain sufficient information to fundamentally change the picture. For the impulse response of price level, neither the standard VAR nor the VAR+1 factor model predicts a "price puzzle", however, the FAVAR model estimates a more drastic change.

Note from Figure 8 that an increase in the money base immediately stimulates industrial production in the short-run. Our results, together with the results of Burdekin and Siklos (2008), show that the People's Bank of China successfully uses the M2 target to ensure economic growth from 2001 to 2008. This implies that the McCallum-type monetary rule is well fit for the Chinese scenario.

Insert Table 5 here

From the right panels of Figures 1 and 2, we can see how monetary policy shocks affect disaggregated prices. The sectoral prices respond only mildly in the first few months after a monetary shock but continue to adjust as time evolves, and finally peak at around one year's time. Note from Table 5 that the autocorrelation coefficients of inflation rate are high. After 12 months, the autocorrelation coefficient remains at 0.62, implying a high degree of persistence in sectoral inflation and providing support to a sticky price model setting for sector prices.

Nevertheless, results from Figures 1 and 2 seem to imply long-run money non-neutrality since sectoral price responses do not converge to the same level after four years. As pointed out by BGM (2009), long-run price responses to monetary shocks are not precisely estimated because these price responses do not take into account

"the uncertainty surrounding the estimated sectoral price responses." To cope with this problem, we follow BGM's procedure by imposing a restriction wherein all price responses are made equal to the aggregate price level at a given long-run horizon[16]. Then, we examine whether or not all sectoral price series indeed reach the same level at the end of the horizon.

Insert Figure 9 here

Insert Figure 10 here

Figures 9 and 10 show that most of the sectoral prices do not display a significant relative price change. Therefore, we conclude that sectoral price responses converge to the same level at horizons of four years and ten years. Hence, the long-run money neutrality is not necessarily violated.

5.2 Effects of monetary shocks in India

From Figure 11, we can see that the FAVAR model significantly improves the estimation results of the effects of monetary shocks.[17] However, long-run money non-neutrality still exists, which implies that we might need to include more factors into the FAVAR. For price level, the standard VAR and VAR+1 factor models display a "price puzzle", i.e., price level increases with the increase in interest rate. The puzzle does not exist in the FAVAR framework.

Comparing Figures 11 and 12, it seems that the Taylor-type monetary policy rule works better for the Indian setting from 1996 to 2008, wherein the economy reacts to interest rate-type monetary policy.

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[16]We adopt four years and ten years as the length of long-run horizon in this thesis.

[17] For example, in the industrial production, the standard VAR model generates the "wrong" sign for the estimates: an unexpected interest rate increase results in a rise in economic activity. The FAVAR model and VAR+1 factor models are able to correct this.

Insert Figure 11 here

Insert Figure 12 here

Insert Table 6 here

From Figures 3 and 4, responses of the disaggregated prices to monetary shocks in India also suggest that changes in interest rates have a more systematic impact on sectoral price compared to money base. Similar to the US and China, sectoral prices in India react mildly to a monetary policy shock for a few months, but continue to adjust over time. Table 6 shows that the autocorrelation coefficients in inflation are high, suggesting that there is a high degree of persistence in sectoral inflation. This gives support to apply sticky price models to Indian data.

Insert Figure 13 here

Insert Figure 14 here

Similarly, we impose a long-run restriction on sectoral prices that all of them converge to the aggregate price level at horizons of four years and ten years. Figures 13 and 14 provide empirical evidence that all sectoral prices converge to the same level at the end of four years and ten years. Hence, there is no violation of the long-run money neutrality.

Chapter 6 Conclusion

In this thesis, we adopt the FAVAR framework to study the fluctuations of aggregate and disaggregated price series in China and India due to macroeconomic and sector-specific shocks. We divide the empirical analysis of this thesis into two parts. First, we disentangle the sources of aggregate and disaggregated inflation in terms of sector-specific, common component, and monetary policy shocks. Second,

we study the effects of the abovementioned three shocks on the aggregate and disaggregated price series. Our FAVAR framework enables us to study the price behavior in each sector of the economy using a large information set.

A common feature found for China and India is that the volatility of sectoral prices is higher than in aggregate price series. For China, most of the fluctuations in aggregate price series come from common macroeconomic shocks; for the disaggregated price series, most of the fluctuations come from disturbances in sector-specific components, such as supply-type shocks. For India, however, fluctuations in both the aggregate and disaggregated price series are due to sector-specific disturbances.

As far as inflation persistence is concerned, China and India manifest different situations. For India, persistence is weak in both aggregate and disaggregated levels. For China, fluctuations in the aggregate price series are more persistent than those in disaggregated price series. In sectors where price is volatile, the persistence also remains high. However, India's price series behavior is found consistent with Calvo's sticky price model, in that sectors with highly sticky prices tend to have low price volatility and high persistence.

In terms of the effects of macroeconomic and sector-specific shocks on sectoral price series, China, India, and the United States present a unanimous picture. Their disaggregated prices adjust immediately after a sector-specific shock, but these effects are merely short-lived. When they face a common component shock, the price response is long-lasting and sluggish.

We also find that urban and rural prices behave somewhat similarly in China and India. When there is a sector-specific shock, rural CPIs in both countries respond more drastically than do urban CPIs. For common macroeconomic

disturbances and monetary shocks, however, rural and urban CPIs respond similarly. Therefore, we can safely conclude that sector-specific disturbances result in differences in urban–rural price behavior.

Comparing the results to standard VARs, the FAVAR seems capable of solving the long-run money non-neutrality problem. The empirical findings also support the McCallum-type of monetary policy rule for China and the Taylor-type monetary policy rule for India. The improvement in model estimation brought about by the FAVAR framework is even more obvious for India, as indicated by the disappearance of the "price puzzle".

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Table 1: China volatility and persistence of monthly inflation series

		Standard deviation (%)			R^2 (Comm.)			Persistence
		Inflation	Comm.	Sector-specific		Inflation	Comm.	Sector-specific
			comp.				comp.	
Aggregate series								
PPI	Total	0.87	0.77	0.42	0.77	0.62	0.91	0.40
	Light Industry	0.35	0.30	0.19	0.71	0.69	0.90	0.09
	Heavy Industry	1.43	1.17	0.82	0.67	0.57	0.91	0.38
	Producer Goods	1.10	0.93	0.58	0.72	0.61	0.91	0.42
	Consumer Goods	0.33	0.24	0.23	0.53	0.61	0.92	0.25
Disaggregated series								
PPI	Average	1.30	0.73	1.03	0.27	0.22	0.74	0.01
	Median	0.71	0.28	0.66	0.27	0.41	0.85	0.01
	Minimum	0.35	0.09	0.27	0.02	-0.75	-0.20	-0.75
	Maximum	7.66	4.95	5.85	0.71	0.79	0.95	0.58
	Std.	1.46	1.01	1.10	0.21	0.44	0.26	0.37

Table 2: China cross-sectional correlations of various statistics

	Sd (π_i)	Sd ($\lambda_i' C$)	Sd (e_i)	R^2	$\rho(\pi_i)$	$\rho(\lambda_i' C)$	$\rho(e_i)$	AC1	AC12	IRF6	IRF12
Sd (π_i)	1.00	0.98	0.99	0.42	0.29	0.17	0.26	-0.32	0.07	-0.31	-0.13
Sd ($\lambda_i' C$)		1.00	0.94	0.55	0.40	0.22	0.33	-0.33	0.12	-0.31	-0.12
Sd (e_i)			1.00	0.30	0.20	0.13	0.20	-0.31	0.05	-0.30	-0.12
R^2				1.00	0.84	0.39	0.61	-0.22	0.19	0.01	0.13
$\rho(\pi_i)$					1.00	0.51	0.87	-0.19	0.15	-0.00	0.10
$\rho(\lambda_i' C)$						1.00	0.35	-0.11	0.02	0.02	0.08
$\rho(e_i)$							1.00	-0.20	-0.01	-0.10	0.03
AC1								1.00	-0.34	0.37	0.34
AC12									1.00	0.14	0.15
IRF6										1.00	0.97
IRF12											1.00

Notes: ρ(), same as Table 1, is based on AR process. AC1 and AC12 are the first- and twelfth-order autocorrelations of the inflation response of π_i to a monetary shock. For China, the monetary instrument is M2. IRF6 and IRF12 are price level responses to a monetary shock, at horizons of 6 months and 12 months and in terms of percentage deviation from price level prior to a monetary shock.

Table 3: India volatility and persistence of monthly inflation series

	Standard deviation (%)			R^2 (Comm.)			Persistence
	Inflation	Comm.	Sector-specific		Inflation	Comm.	Sector-specific
		comp.				comp.	
Aggregate series							
WPI Total	0.60	0.35	0.48	0.35	0.14	0.03	0.08
Primary Articles	1.31	0.88	0.97	0.4	0.04	0.05	-0.16
Fuel, Power, etc.[18]	1.77	0.53	1.69	0.09	-0.07	0.41	0.00
Manuf. Products	0.47	0.19	0.43	0.1	0.36	0.21	0.25
Disaggregated series							
WPI Average	2.20	0.56	2.11	0.07	0.16	0.35	0.12
Median	1.79	0.42	1.74	0.06	0.15	0.37	0.09
Minimum	0.50	0.11	0.48	0.01	-0.42	-0.28	-0.33
Maximum	7.64	4.21	7.53	0.35	0.68	0.93	0.66
Std.	1.53	0.59	1.44	0.05	0.21	0.33	0.21

[18] Fuel, Power, Light & Lubricants

Table 4: India cross-sectional correlations of various statistics

	Sd (π_i)	Sd ($\lambda_i' C$)	Sd (e_i)	R^2	$\rho(\pi_i)$	$\rho(\lambda_i' C)$	$\rho(e_i)$	AC1	AC12	IRF6	IRF12
Sd (π_i)	1.00	0.76	0.99	0.20	-0.31	-0.16	-0.25	-0.06	-0.08	-0.16	-0.31
Sd ($\lambda_i' C$)		1.00	0.69	0.72	-0.35	-0.27	-0.28	-0.19	-0.19	0.02	-0.17
Sd (e_i)			1.00	0.11	-0.29	-0.14	-0.23	-0.04	-0.07	-0.19	-0.31
R^2				1.00	-0.18	-0.28	-0.14	-0.37	-0.34	0.09	-0.02
$\rho(\pi_i)$					1.00	0.36	0.95	0.09	-0.01	-0.32	-0.26
$\rho(\lambda_i' C)$						1.00	0.23	0.49	0.43	-0.35	-0.30
$\rho(e_i)$							1.00	0.06	-0.06	-0.24	-0.21
AC1								1.00	0.78	-0.09	-0.08
AC12									1.00	-0.08	-0.08
IRF6										1.00	0.97
IRF12											1.00

Notes: ρ(), same as Table 3, is based on AR process. AC1 and AC12 are the first- and twelfth-order autocorrelations of the inflation response of π_i to a monetary shock. For India, the monetary instrument is RBI's bank rate. IRF6 and IRF12 are price level responses to a monetary shock, at horizons of 6 months and 12 months and in terms of percentage deviation from price level prior to a monetary shock.

Table 5: Response of price series to a monetary policy shock in China[19]

	Autocorrelation of π_{it} conditional on shock				Price responses (in percent)	
	1st-order	3rd-order	6th-order	12th-order	6 mon.	12 mon.
Aggregate series						
PPI Total	0.99	0.95	0.87	0.70	-1.82	-3.09
Light Industry	0.99	0.95	0.87	0.70	-0.01	-0.01
Heavy Industry	0.99	0.95	0.87	0.70	-0.03	-0.05
Producer Goods	0.99	0.95	0.87	0.70	-0.02	-0.04
Consumer Goods	0.99	0.95	0.88	0.70	-0.01	-0.01
Consumer Goods: Food	0.99	0.95	0.88	0.71	-0.01	-0.02
Consumer Goods: Clothing	0.99	0.95	0.86	0.67	-0.00	-0.00
Consumer Goods: Daily Use Articles	0.99	0.95	0.87	0.70	-0.00	-0.01
Consumer Goods: Durable	0.98	0.92	0.78	0.51	-0.00	-0.00
Disaggregated series						
PPI Average	0.99	0.94	0.83	0.62	-1.49	-2.61
Median	0.99	0.95	0.87	0.68	-0.34	-0.90
Minimum	0.96	0.76	0.33	-0.27	-13.15	-21.50
Maximum	0.99	0.95	0.89	0.73	0.33	0.38
Std.	0.01	0.04	0.10	0.18	2.67	4.32

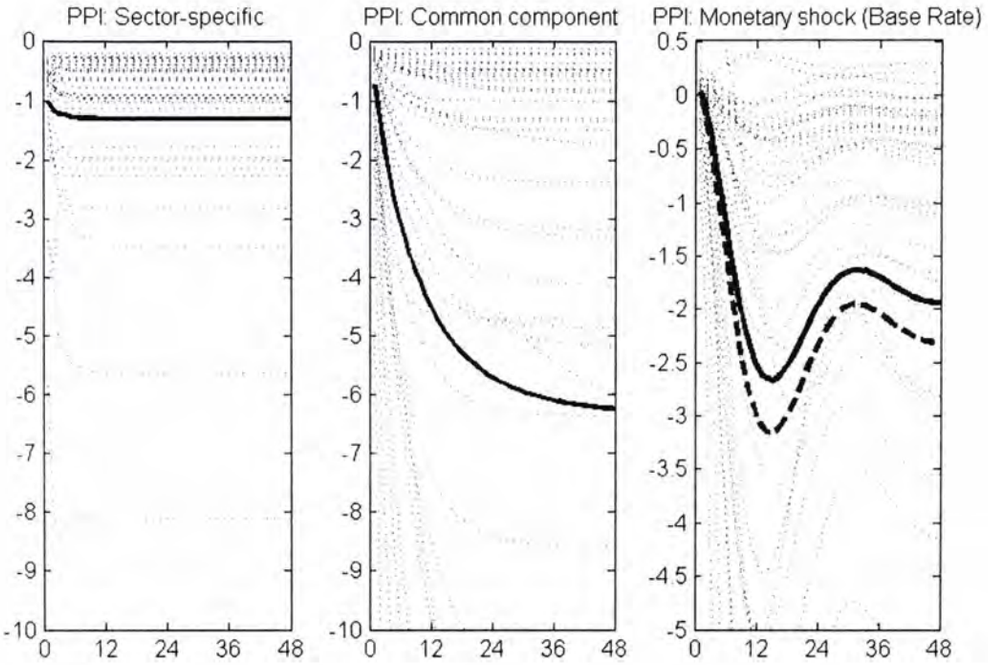
[19] The monetary policy shock is an unexpected 0.25% increase in China central bank's Base Rate.

Table 6: Response of price series to a monetary policy shock in India[20]

	Autocorrelation of π_{it} conditional on shock				Price responses (in percent)	
	1st-order	3rd-order	6th-order	12th-order	6 mon.	12 mon.
Aggregate series						
WPI Total	0.97	0.91	0.85	0.70	-0.02	-0.05
Primary Articles	0.97	0.89	0.84	0.70	-0.00	-0.00
Fuel, Power, Light & Lubricants	0.97	0.92	0.84	0.67	0.00	0.00
Manuf. Products	0.98	0.92	0.84	0.68	-0.00	-0.00
Disaggregated series						
PPI Average	0.97	0.89	0.81	0.66	-0.04	-0.07
Median	0.98	0.93	0.86	0.72	-0.04	-0.07
Minimum	0.80	0.57	0.32	0.24	-0.66	-1.06
Maximum	0.98	0.94	0.88	0.74	0.32	0.41
Std.	0.03	0.09	0.13	0.12	0.17	0.25

[20] The monetary policy shock is an unexpected 0.25% increase in India central bank's Bank Rate.

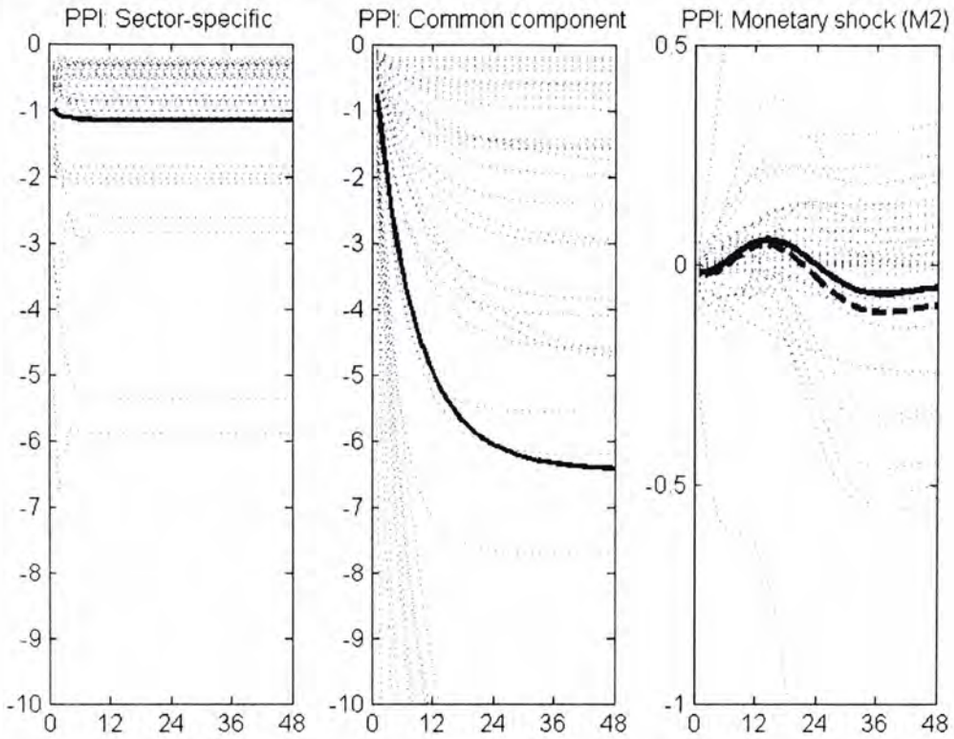
Figure 1:[21] China sectoral price responses to shocks (Base Rate as the monetary instrument)



Notes: Sectoral prices respond to a sector-specific shock (left panel: one standard deviation of e_{it}), to a common component shock (middle panel: one standard deviation of $\lambda_i' C_t$), and finally to a monetary shock (right panel). The monetary shock is an unexpected 25 basis points increase in Central Bank's base interest rate for Figure 1. Thick solid line represents unweighted average response while the thick dashed line is the aggregate PPI response to a monetary shock.

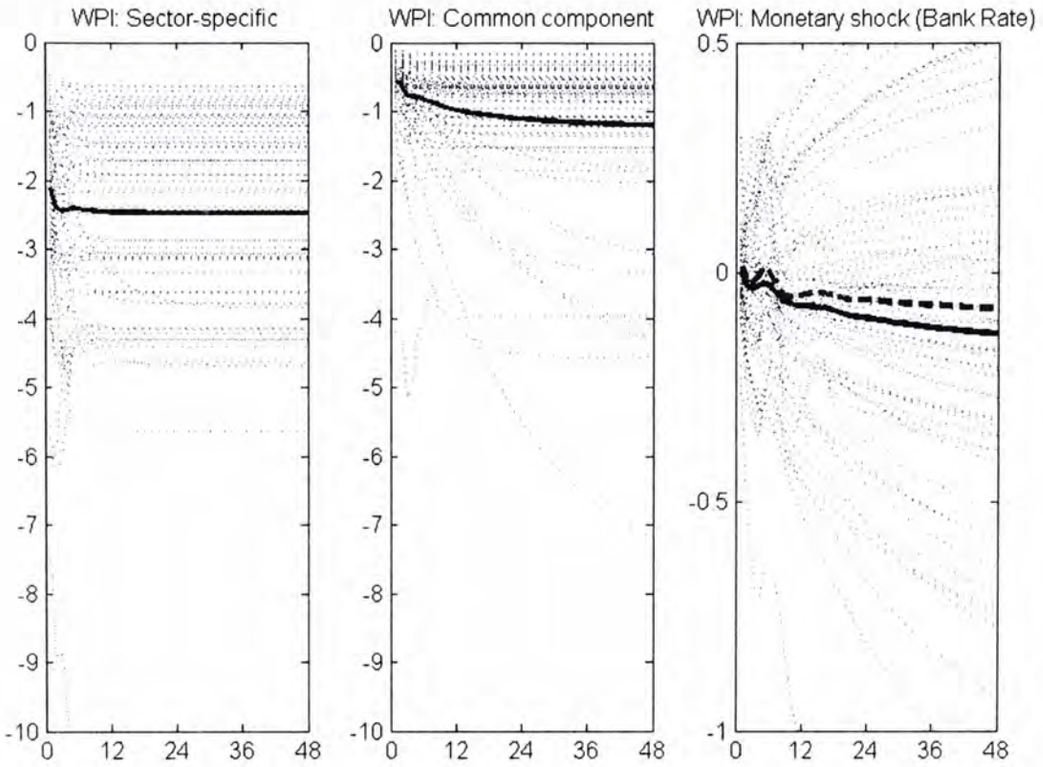
[21] For all figures below, x-axis indicates length of months and y-axis is the percentage change.

Figure 2: China sectoral price responses to shocks (M2 as the monetary instrument)



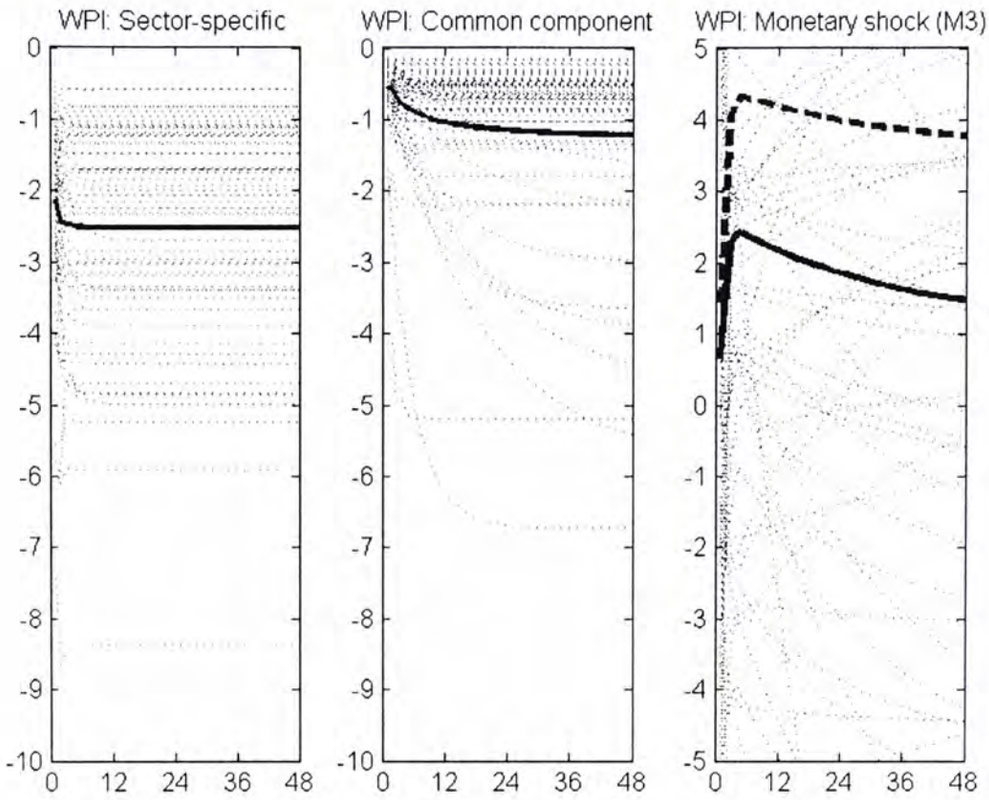
Notes: Sectoral prices respond to a sector-specific shock (left panel: one standard deviation of e_{it}), to a common component shock (middle panel: one standard deviation of $\lambda_i' C_t$), and finally to a monetary shock (right panel). The monetary shock is an unexpected 0.25% increase in M2 for Figure 2. Thick solid line represents unweighted average response while the thick dashed line is the aggregate PPI response to a monetary shock.

Figure 3: India sectoral price responses to shocks (Bank Rate as the monetary instrument)



Notes: The monetary shock is an unexpected 25 basis points increase in RBI's Bank Rate for Figure 3. Thick solid line represents unweighted average response while the thick dashed line is the aggregate WPI response to a monetary shock.

Figure 4: India sectoral price responses to shocks (M3 as the monetary instrument)



Notes: The monetary shock is an unexpected 0.25% increase in M3 for Figure 4. Thick solid line represents unweighted average response while the thick dashed line is the aggregate WPI response to a monetary shock.

Figure 5: China urban and rural CPI responses to various shocks

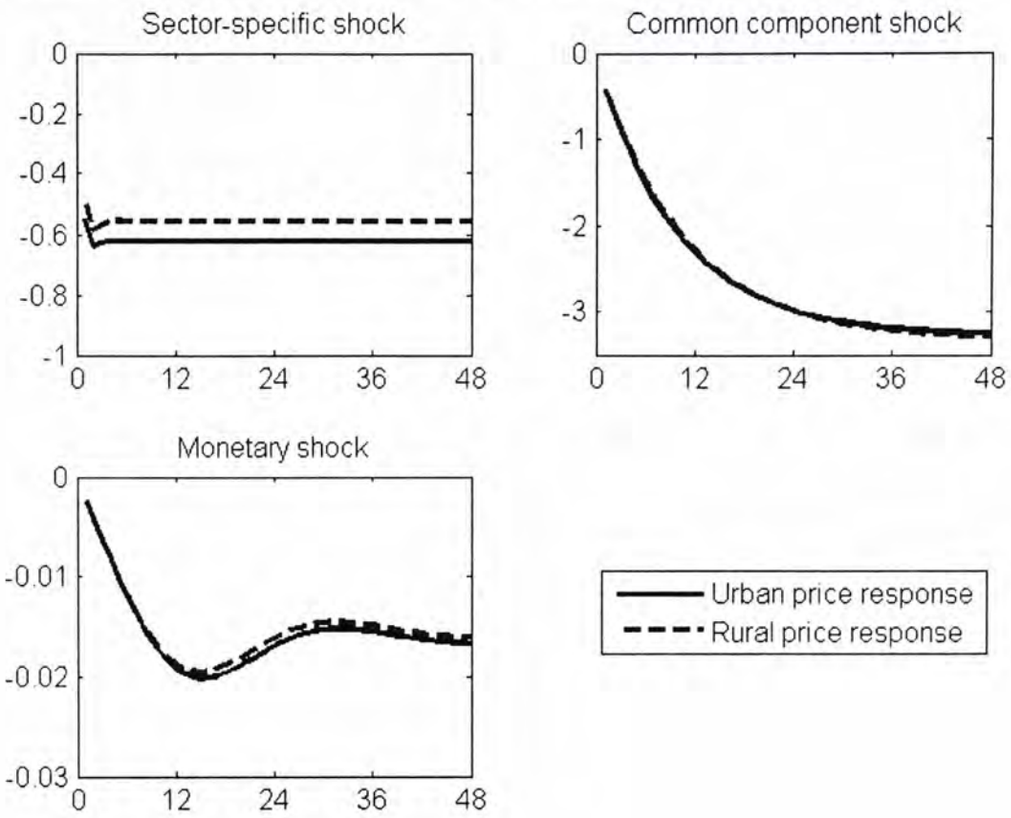


Figure 6: India urban and rural CPI responses to various shocks

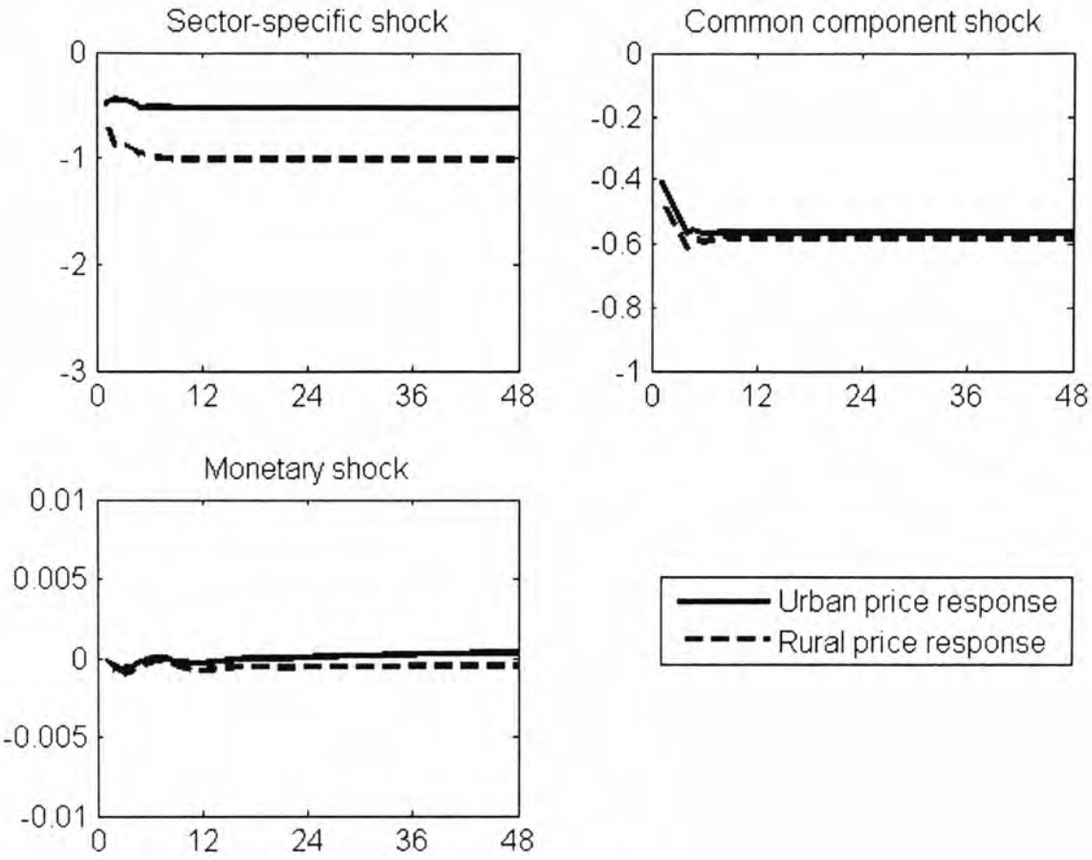
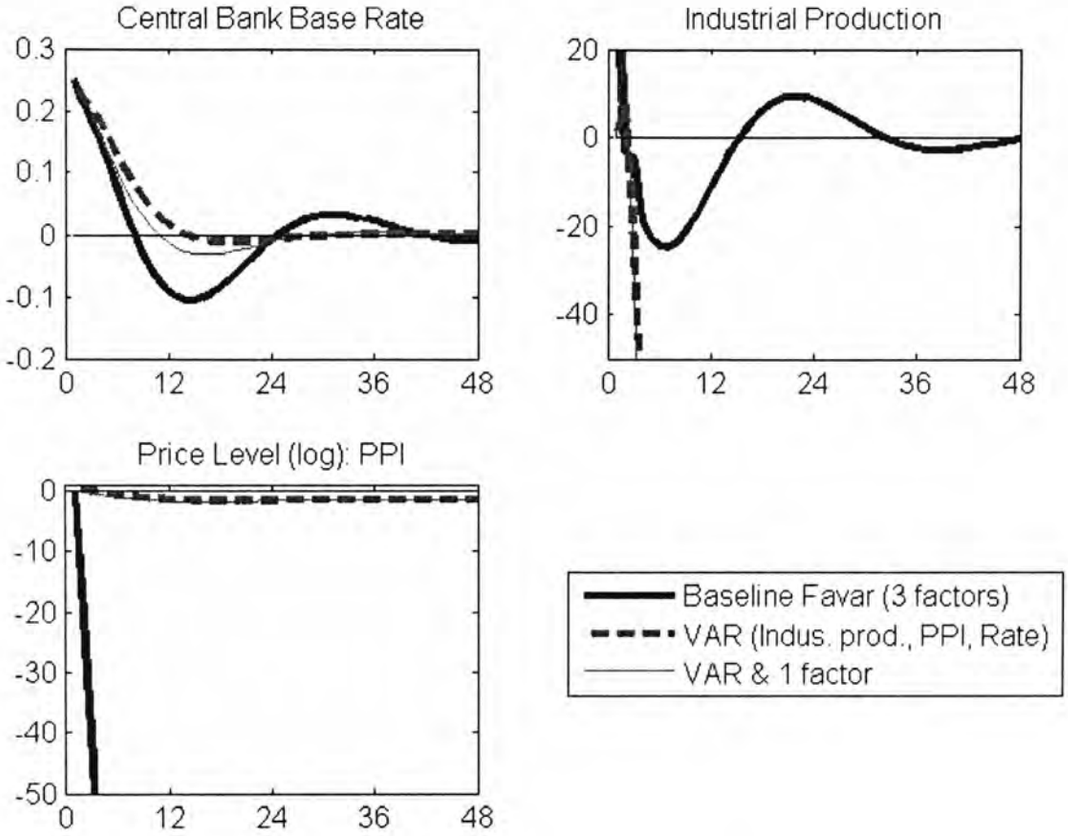
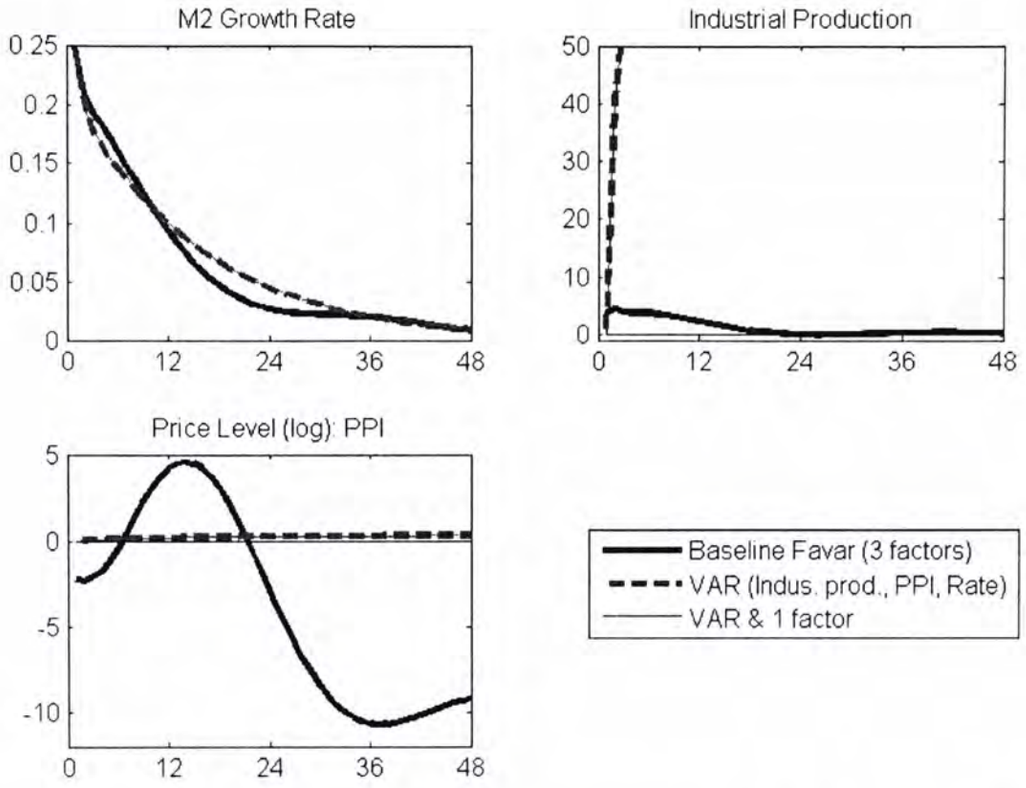


Figure 7: China impulse responses to an identified monetary shock (Base Rate)



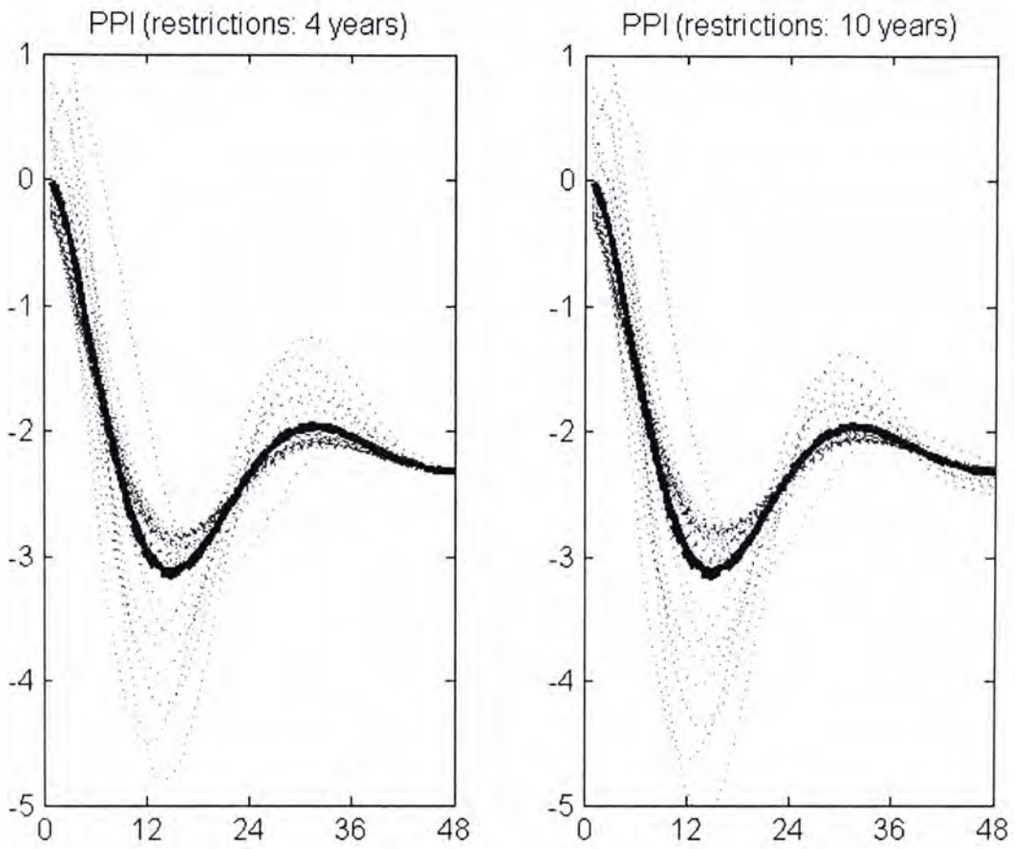
Notes: Responses (in percent) are based on three models: the proposed baseline FAVAR, an ordinary VAR with three variables, and VAR plus the first estimated principal component (factor) of the large data set. In the third graph of Fig. 7, VAR and VAR&1 factor model both predicted a permanent negative price response, but at a scale around 2% while the FAVAR estimated a negative 300% change.

Figure 8: China impulse responses to an identified monetary shock (M2)



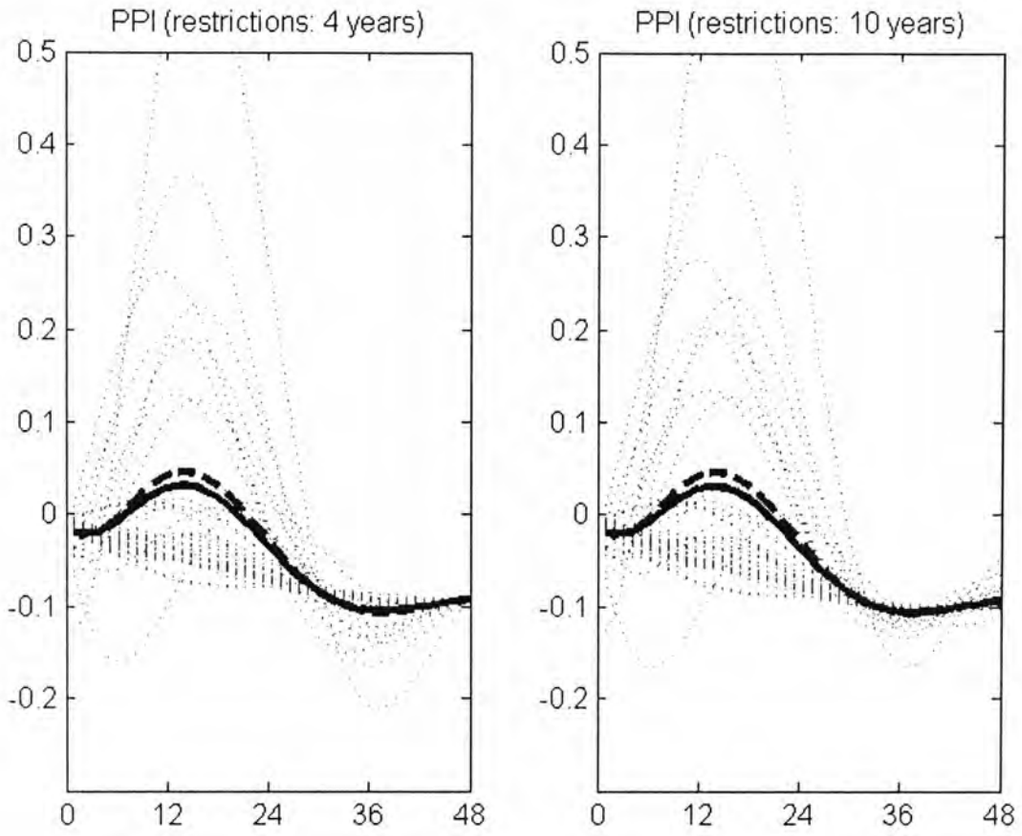
Notes: Responses (in percent) are based on three models: the proposed baseline FAVAR, an ordinary VAR with three variables, and VAR plus the first estimated principal component (factor) of the large data set. In the third graph of Fig. 8, VAR and VAR&1 factor model both predicted a permanent positive price response at around 0.3%.

Figure 9: China sectoral price responses to monetary shocks with long-run restriction (Base Rate)



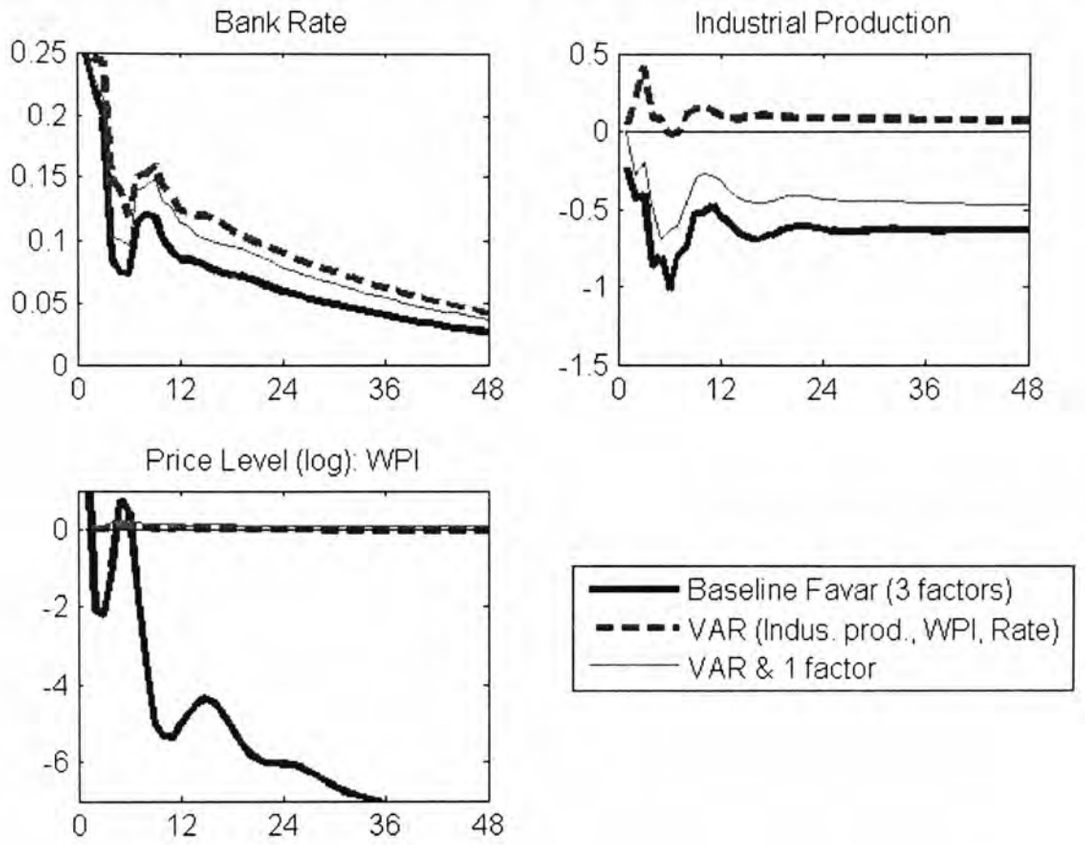
Note: Estimated impulse responses of sectoral prices (in percent) to an identified monetary policy shock. The monetary shock is an unexpected increase of 25 basis points in central bank's base rate. Thick solid lines represent unweighted average responses. Thick dashed lines represent the response of the aggregate PPI to a monetary policy shock. In left panels, all price responses are constrained to be equal to the aggregate price response at the horizon of four years. In right panels, the constraints apply at the horizon of ten years.

Figure 10: China sectoral price responses to monetary shocks with long-run restriction (M2)



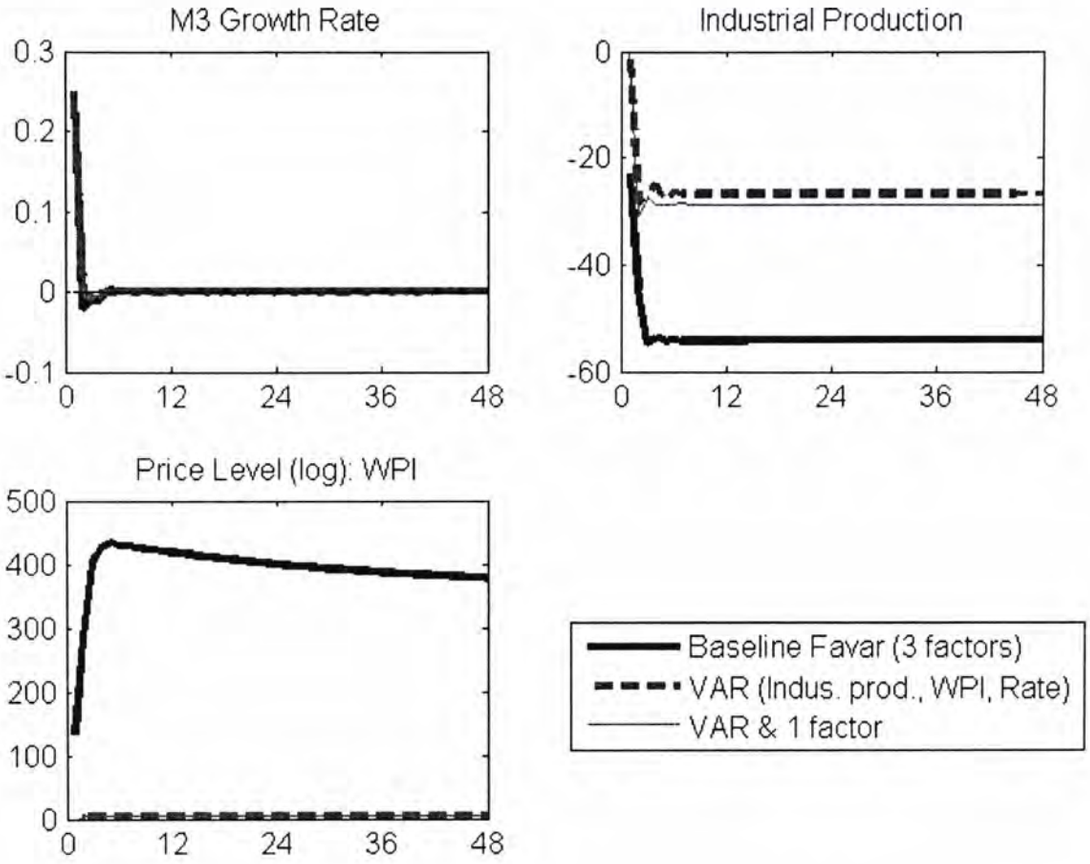
Note: Estimated impulse responses of sectoral prices (in percent) to an identified monetary policy shock. The monetary shock is an unexpected 25 basis points increase in M2. Thick solid lines represent unweighted average responses. Thick dashed lines represent the response of the aggregate PPI to a monetary policy shock. In left panels, all price responses are constrained to be equal to the aggregate price response at the horizon of four years. In right panels, the constraints apply at the horizon of ten years.

Figure 11: India impulse responses to an identified monetary shock (Bank Rate)



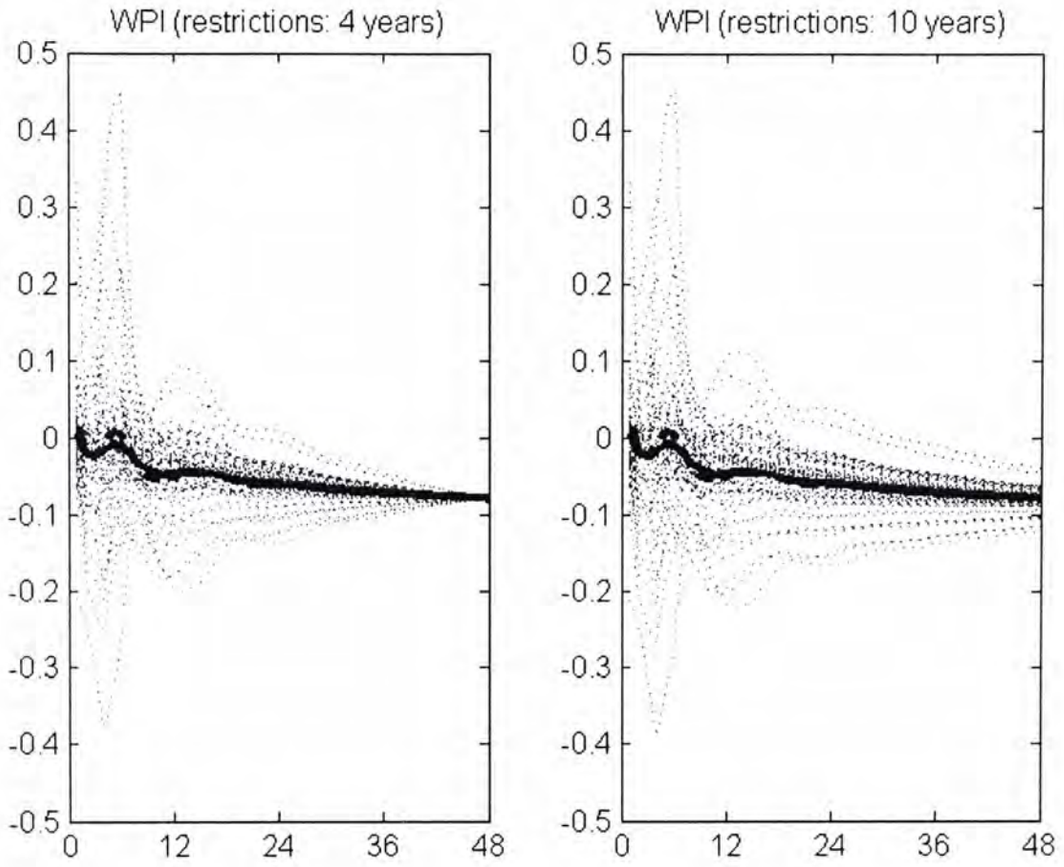
Notes: Responses (in percent) are based on three models: the proposed baseline FAVAR, an ordinary VAR with three variables, and VAR plus the first estimated principal component (factor) of the large data set. In the third graph of Fig. 11, VAR and VAR&1 factor model both predicted a permanent positive price response, but peaked at around 0.2% while the FAVAR estimated a negative 7% change.

Figure 12: India impulse responses to an identified monetary shock (M3)



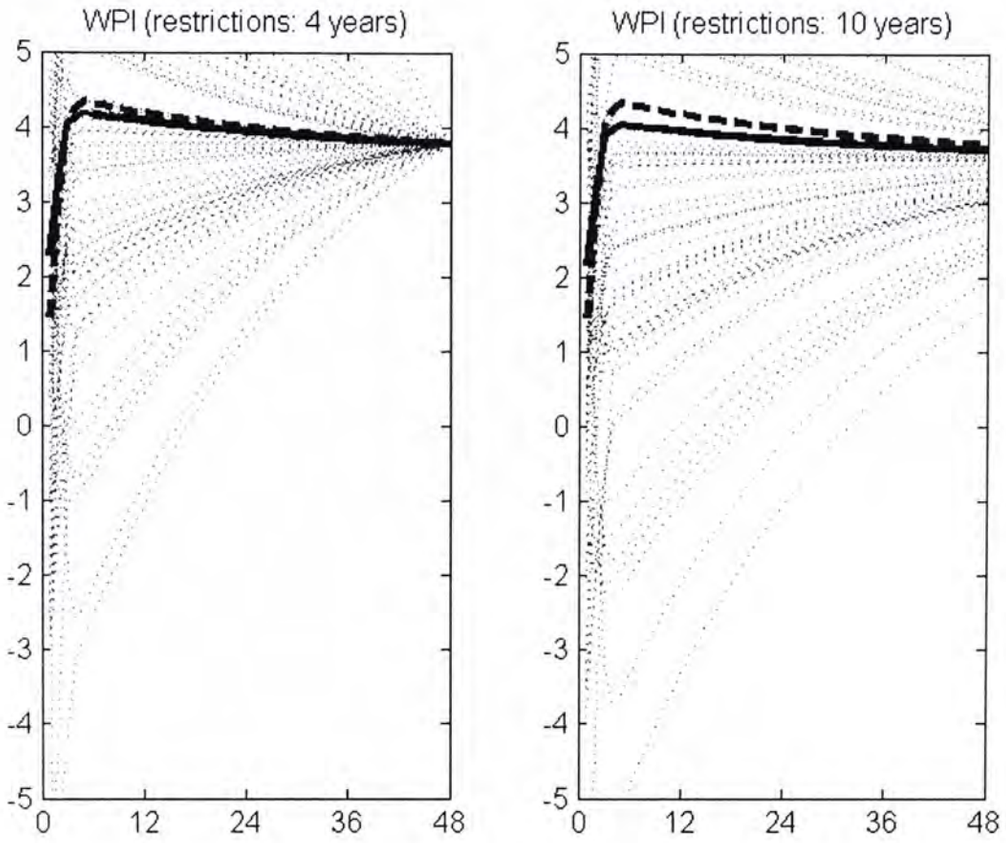
Notes: Responses (in percent) are based on three models: the proposed baseline FAVAR, an ordinary VAR with three variables, and VAR plus the first estimated principal component (factor) of the large data set. In the third graph of Fig. 12, VAR and VAR&1 factor model both predicted a permanent positive price response at around 8%.

Figure 13: India sectoral price responses to monetary shocks with long-run restriction (Bank Rate)



Note: Estimated impulse responses of sectoral prices (in percent) to an identified monetary policy shock. The monetary shock is an unexpected increase of 25 basis points in central bank's bank rate. Thick solid lines represent unweighted average responses. Thick dashed lines represent the response of the aggregate WPI to a monetary policy shock. In left panels, all price responses are constrained to be equal to the aggregate price response at the horizon of four years. In right panels, the constraints apply at the horizon of ten years.

Figure 14: India sectoral price responses to monetary shocks with long-run restriction (M3)



Note: Estimated impulse responses of sectoral prices (in percent) to an identified monetary policy shock. The monetary shock is an unexpected 25 basis points increase in M3. Thick solid lines represent unweighted average responses. Thick dashed lines represent the response of the aggregate WPI to a monetary policy shock. In left panels, all price responses are constrained to be equal to the aggregate price response at the horizon of four years. In right panels, the constraints apply at the horizon of ten years.

Appendix

Transformation code: 1-no transformation; 2-first difference; 4-logarithm (natural); 5-first difference of logarithm.

China (2001:2—2008:12)

	Description	Transformation
	BAN---Banking Statistics	
1	Central Bank: Liabilities: Reserve Money (RM)	5
2	Central Bank: Liabilities: RM: Currency Issued	5
3	Central Bank: Liabilities: RM: Liabilities to Financial Inst	5
4	Central Bank: Liabilities: Deposits of Government (DG)	5
5	Central Bank: Assets: Net Foreign Assets	5
6	Central Bank: Assets: Net Foreign Assets: Foreign Exchange	5
7	Central Bank: Assets: Net Foreign Assets: Other	5
8	Central Bank: Assets: Claims on Government	5
	EXR---Exchange Rates	
9	Spot Exchange Rate: Period Avg: SAFE: RMB to US Dollar	5
10	Spot Exchange Rate: Period Avg: SAFE: RMB to Hong Kong Dollar	5
11	Spot Exchange Rate: Period Avg: SAFE: RMB to Japanese Yen	5
12	Spot Exchange Rate: Period Avg: SAFE: RMB to EURO	5
13	Spot Exchange Rate: Period Avg: SAFE: RMB to British Pound	5
14	Spot Exchange Rate: Period Avg: SAFE: RMB to Canadian Dollar	5
15	Spot Exchange Rate: Period Avg: SAFE: RMB to Swiss Franc	5
16	Spot Exchange Rate: Period Avg: SAFE: RMB to Swedish Krone	5
17	Spot Exchange Rate: Period Avg: SAFE: RMB to Norway Krone	5
18	Spot Exchange Rate: Period Avg: SAFE: RMB to Danish Krone	5
19	Spot Exchange Rate: Period Avg: SAFE: RMB to Singapore Dollar	5
20	Spot Exchange Rate: Period Avg: SAFE: RMB to Australian Dollar	5
	FTD---Foreign Trade	
21	Exports fob	5
22	Imports cif	5
23	Exports fob: Revised	5
24	Imports cif: Revised	5
25	Exports fob: ytd	5
26	Imports cif: ytd	5
	GOV---Government Revenue and Expenditure	
27	Government Revenue	5
28	Government Expenditure	5
29	Government Revenue: Taxes	5
30	Government Revenue: Taxes: Tariffs	5

31	Government Revenue: Value Added	5
32	Government Revenue: Business	5
33	Government Revenue: Stamp Duty	5
	HSS---Houses Built and Sales	
34	Real Estate Investment: ytd: Total	5
35	Real Estate Inv: ytd: Residential Buildings	5
36	Real Estate Inv: ytd: Office Buildings	5
37	Real Estate Inv: ytd: Commercial Buildings	5
38	Real Estate Inv: ytd: Others	5
39	Real Estate Inv: Source of Fund: ytd: Total	5
40	Real Estate Inv: Source of Fund: ytd: Domestic Loans	5
41	Real Estate Inv: Source of Fund: ytd: Foreign Inv	5
42	Real Estate Inv: Source of Fund: ytd: Foreign Inv: Direct	5
43	Real Estate Inv: Source of Fund: ytd: Self Raised	5
44	Real Estate Inv: Source of Fund: ytd: Self Raised: Self Owned	5
45	Real Estate Inv: Source of Fund: ytd: Others	5
46	Real Estate Inv: Source of Fund: ytd: Others: Deposits & Adv Payment	5
47	Value of Building Completed: ytd: Residential: Total	5
48	Commodity Bldg Selling Price: YTD Average	5
49	Commodity Bldg Selling Price: YTD Average: Residential	5
50	Commodity Building Sold: ytd: Total	5
	INT---Interest Rates	
51	Central Bank Base Interest Rate: Less Than 20 Days	1
52	Central Bank Base Interest Rate: 3 Months or Less	1
53	Central Bank Base Interest Rate: 6 Months or Less	1
54	Central Bank Base Interest Rate: Annual	1
55	Base Lending Rate: Working Capital: 6 Months	1
56	Base Lending Rate: Working Capital: 1 Year	1
57	Base Lending Rate: Capital Construction: Less than 3 Year	1
58	Base Lending Rate: Capital Construction: Less than 5 Year	1
59	Base Lending Rate: Capital Construction: Less than 10 Year	1
60	Savings Deposits Rate	1
61	Time Deposits Rate: 3 Months	1
62	Time Deposits Rate: 6 Months	1
63	Time Deposits Rate: 1 Year	1
64	Time Deposits Rate: 2 Year	1
65	Time Deposits Rate: 3 Year	1
66	Time Deposits Rate: 5 Year	1
67	National Interbank Offered Rate: Weighted Avg: NIBFC: 7 Days	1
68	National Interbank Offered Rate: Weighted Avg: NIBFC: 30 Days	1
69	National Interbank Offered Rate: Weighted Avg: NIBFC: 60 Days	1
70	National Interbank Offered Rate: Weighted Avg: NIBFC: 90 Days	1
71	National Interbank Bond Repurchase: WA Rate: NIBFC: 7 Day	1
72	National Interbank Bond Repurchase: WA Rate: NIBFC: 14 Day	1
73	National Interbank Bond Repurchase: WA Rate: NIBFC: 21 Day	1

74	National Interbank Bond Repurchase: WA Rate: NIBFC: 1 Month	1
75	National Interbank Bond Repurchase: WA Rate: NIBFC: 2 Month	1
	INV---Investment	
76	FDI: No of Contract: ytd: Total	5
77	FDI: No of Contract: ytd: Joint Ventures	5
78	FDI: No of Contract: ytd: Cooperative Ventures	5
79	FDI: No of Contract: ytd: Foreign Enterprises	5
	MON---Money and Credit Quantity Aggregates and Foreign Reserves	
80	Exports fob: Revised	5
81	Imports cif: Revised	5
82	Exports fob: ytd	5
83	Imports cif: ytd	5
84	Money Supply M0	5
85	Money Supply M1	5
86	Money Supply M2	5
87	Demand Deposits	5
88	Quasi Money	5
89	Saving Deposits	5
90	Time Deposits	5
91	Other Deposits	5
92	Money Supply M0: YoY: Growth Rate	1
93	Money Supply M1: YoY: Growth Rate	1
94	Money Supply M2: YoY: Growth Rate	1
95	Demand Deposits: YoY: Growth Rate	1
96	Quasi Money: YoY: Growth Rate	1
97	Savings Deposits: YoY: Growth Rate	1
98	Time Deposits: YoY: Growth Rate	1
99	Financial Institution Deposits	5
100	Financial Institution Deposits: Savings Deposits	5
101	Financial Institution Deposits: Corporate Deposits	5
102	Financial Institution Loans	5
103	Financial Institution Loans: Short Term	5
104	Financial Institution Loans: Medium and Long Term	5
105	Financial Institution Loans: YoY: Growth Rate	1
106	Financial Institutions Credit Funds: Funds Sources	5
107	Financial Institutions CF: Deposits	5
108	Financial Institutions CF: Loans	5
109	Foreign Reserves	5
	OUT---Real Output and Income	
110	VAI: YoY Growth	1
111	VAI: YoY Growth: Light Industry	1
112	VAI: YoY Growth: Heavy Industry	1
113	VAI: YoY Growth: State Owned & Holding Enterprises	1
114	VAI: YoY Growth: Collective Ownership	1

115	VAI: YoY Growth: Partnership Joint Venture	1
116	VAI: YoY Growth: Share Holding Enterprises	1
117	VAI: YoY Growth: Foreign, HK, Macau & TW Funded Enterprises	1
	PRI---Price Indexes	
118	Consumer Price Index (China)	5
119	Consumer Price Index: Food (China)	5
120	Consumer Price Index: Tobacco, Liquors and Articles (China)	5
121	Consumer Price Index: Clothing (China)	5
122	Consumer Price Index: Household Facility (China)	5
123	Consumer Price Index: Medicines and Medical (China)	5
124	Consumer Price Index: Transport & Telecom (China)	5
125	Consumer Price Index: Recreation, Education & Cultural (China)	5
126	Consumer Price Index: Residence (China)	5
127	Consumer Price Index: Urban (China)	5
128	Consumer Price Index: Rural (China)	5
129	Consumer Price Index: 36 Cities Average (China)	5
130	Retail Price Index (China)	5
131	Retail Price Index:Urban (China)	5
132	Retail Price Index: Rural (China)	5
133	Retail Price Index: 36 Cities Average (China)	5
134	Producer Price Index: Industrial Products (China)	5
135	Producer Price Index: Industrial Products: Light Industry (China)	5
136	Producer Price Index: Industrial Products: Heavy Industry (China)	5
137	Producer Price Index: IP: Producer Goods (China)	5
138	PPI: IP: Producer Goods: Excavation (China)	5
139	PPI: IP: Producer Goods: Raw Material (China)	5
140	PPI: IP: Producer Goods: Manufacturing (China)	5
141	PPI: IP: Consumer Goods (China)	5
142	PPI: IP: Consumer Goods: Food (China)	5
143	PPI: IP: Consumer Goods: Clothing (China)	5
144	PPI: IP: Consumer Goods: Daily Use Articles (China)	5
145	PPI: IP: Consumer Goods: Durable (China)	5
146	Purchasing PI: Raw Materials (RM): Total (China)	5
	RTS---Retail Sales	
147	Retail Sales of Consumer Goods: YoY Change: ytd	1
148	Retail Sales of Consumer Goods: Wholesale and Retail Trade	5
149	Retail Sales of Consumer Goods: Catering Trade	5
150	Retail Sales of Consumer Goods: Other	5
	SPR---Stock Prices	
151	Index: Shanghai Stock Exchange: Composite	5
152	Index: Shanghai Stock Exchange: A Share	5
153	Index: Shanghai Stock Exchange: B Share	5
154	Index: Shenzhen Stock Exchange: Composite	5
155	Index: Shenzhen Stock Exchange: A Share	5
156	Index: Shenzhen Stock Exchange: B Share	5

	PPI--Disaggregated Producer Price Index	
157	PPI: Industrial Pdts: Coal Mining & Dressing	5
158	PPI: Industrial Pdts: Petroleum & Natural Gas Extraction	5
159	PPI: Industrial Pdts: Ferrous Metals Mining & Dressing	5
160	PPI: Industrial Pdts: Non Ferrous Metals Mining & Dressing	5
161	PPI: Industrial Pdts: Non-Metal Minerals Mining & Dressing	5
162	PPI: Industrial Pdts: Food Manufacturing	5
163	PPI: Industrial Pdts: Beverage Manufacturing	5
164	PPI: Industrial Pdts: Tobacco Processing	5
165	PPI: Industrial Pdts: Textile Industry	5
166	PPI: Industrial Pdts: Garment, Footwear & Headgear Manufacturing	5
167	PPI: Industrial Pdts: Leather, Fur, Down & Related Products	5
168	PPI: Industrial Pdts: Timber Processing, Bamboo, Cane. Palm Fibre	5
169	PPI: Industrial Pdts: Furniture Manufacturing	5
170	PPI: Industrial Pdts: Paper Making & Paper Products	5
171	PPI: Industrial Pdts: Printing & Record Medium Reproduction	5
172	PPI: Industrial Pdts: Cultural, Educational & Sports Articles	5
173	PPI: Industrial Pdts: Coking & Nuclear Fuel & Petroleum Processing	5
174	PPI: Industrial Pdts: Raw Chemical Materials & Chemical Products	5
175	PPI: Industrial Pdts: Medical & Pharmaceutical Products	5
176	PPI: Industrial Pdts: Chemical Fiber Industry	5
177	PPI: Industrial Pdts: Rubber Products	5
178	PPI: Industrial Pdts: Plastic Products	5
179	PPI: Industrial Pdts: Non-Metal Minerals Products	5
180	PPI: Industrial Pdts: Smelting & Pressing of Ferrous Metals	5
181	PPI: Industrial Pdts: Smelting & Pressing of Non-Ferrous Metals	5
182	PPI: Industrial Pdts: Metal Products	5
183	PPI: Industrial Pdts: Universal Equipment Manufacturing	5
184	PPI: Industrial Pdts: Special Purpose Equipment	5
185	PPI: Industrial Pdts: Transportation Equipment	5
186	PPI: Industrial Pdts: Electric Machinery & Equipment	5
187	PPI: Industrial Pdts: Communication, Computer & Other Electronic Eq	5
188	PPI: Industrial Pdts: Instructment, Meter, Cultural, OfficeMachinery	5
189	PPI: Industrial Pdts: Electricity Supply & Production, Heating Power	5
190	PPI: Industrial Pdts: Gas Production & Supply	5
191	PPI: Industrial Pdts: Water Production & Supply	5
192	PPI: Agricultural Input	5

India (1996:6-2008:10)

	Description	**Transformation**
	BAN---Banking Statistics	
1	Reserve Bank: Total Assets or Liabilities	5
2	Reserve Bank: Bank Dept: Deposits	5
3	Reserve Bank: Bank Dept: Other Liabilities	5
4	Reserve Bank: Bank Dept: Notes and Coins	5

5	Reserve Bank: Bank Dept: Balance Held Abroad	5
6	Reserve Bank: Bank Dept: Loans and Advances	5
7	Reserve Bank: Bank Dept: Investment	5
8	Reserve Bank: Bank Dept: Other Assets	5
	EMP---Employment	
9	Employment Exchanges: New Registrations	5
10	Employment Exchanges: Live Registrations	5
11	Employment Exchanges: Vacancies Notified	5
12	Employment Exchanges: Placements Effected	5
	EXR---Exchange Rates	
13	(DC)Spot Exchange Rate: FX Dealer Association: Avg: US Dollar	5
14	(DC)Spot Exchange Rate: FX Dealer Association: Avg: Pound Sterling	5
15	(DC)Spot Exchange Rate: FX Dealer Association: Avg: Deutsche Mark	5
16	(DC)Spot Exchange Rate: FX Dealer Association: Avg: Japanese Yen	5
	FTD---Foreign Trade	
17	Exports: USD	5
18	Imports: USD	5
	INT---Interest Rates	
19	**Bank Rate: End of Period***	1
20	Prime Lending Rate: Five Major Banks	1
21	Treasury Bills: Cut Off Yield: Auction: 3 Months	1
22	Treasury Bills: Cut Off Yield: Auction: 1 Year	1
23	Government Securities Yield: 1 Year	1
24	Government Securities Yield: 2 Years	1
25	Government Securities Yield: 3 Years	1
26	Government Securities Yield: 4 Years	1
27	Government Securities Yield: 5 Years	1
28	Government Securities Yield: 6 Years	1
29	Government Securities Yield: 7 Years	1
30	Government Securities Yield: 8 Years	1
31	Government Securities Yield: 9 Years	1
	MON---Money and Credit Quantity Aggregates and Foreign Reserves	
32	Money Supply: Deposit Money	5
33	Money Supply: M1	5
34	Money Supply: M2	5
35	Money Supply: M3	5
36	Money Supply: M4	5
37	M3: Net Bank Credit to Govt	5
38	M3: Bank Credit to Commercial Sector	5
39	M3: Government Currency Liabilities	5
40	M3: Banking Sector's Net Non Monetary Liabilities	5
41	Reserve Money	5
42	Foreign Reserve	5

43	Foreign Reserve: USD	5
	OUT---Industrial Production Index	
44	Industrial Production Index (IPI)	5
45	Industrial Production Index: Mining and Quarrying	5
46	Industrial Production Index: Manufacturing	5
47	Industrial Production Index: Electricity	5
48	Industrial Production Index: Basic Goods	5
49	Industrial Production Index: Capital Goods	5
50	Industrial Production Index: Intermediate Goods	5
51	Industrial Production Index: Consumer Goods	5
52	Industrial Production Index: Consumer Goods: Durables	5
53	Industrial Production Index: Consumer Goods: Non Durables	5
	PRI---Price Indexes	
54	CPI: Industrial Workers	5
55	CPI: 84p: Urban Non Manual Employees	5
56	Consumer Price Index (CPI): 86p: Agricultural Labourers	5
57	Consumer Price Index: 86p: Rural Labourers	5
58	Wholesale Price Index: Avg	5
59	WPI: Avg: Primary Articles	5
60	WPI: Avg: Fuel, Power, Light & Lubricants	5
61	WPI: Avg: Manufactured Products	5
	SPR---Stock Prices	
62	BSE: Index: Sensitive 30 (Sensex)	5
63	BSE: Index: 100	5
64	BSE: Index: 200	5
65	BSE: Index: Dollex 30	5
66	BSE: Index: Dollex 100	5
67	BSE: Index: Dollex	5
68	NSE: Index: S&P CNX Nifty	5
69	NSE: Index: S&P CNX Defty	5
70	NSE: Index: S&P CNX 500 Equity	5
71	NSE: Index: CNX Nifty Junior	5
72	NSE: Index: CNX IT	5
	WPI---Wholesale Price Indices	
73	WPI: Avg: Primary Articles: Food: Grains	5
74	WPI: Avg: Primary Articles: Food: Fruits & Vegetables (FV)	5
75	WPI: Avg: Primary Articles: Food: Milk	5
76	WPI: Avg: Primary Articles: Food: Egg, Meat and Fish (EM)	5
77	WPI: Avg: Primary Articles: Food: Condiments & Spices (CS)	5
78	WPI: Avg: Primary Articles: Food: Others	5
79	WPI: Avg: Primary Articles: Non Food: Fibres	5
80	WPI: Avg: Primary Articles: Non Food: Oil Seeds (OS)	5
81	WPI: Avg: Primary Articles: Non Food: Others	5
82	WPI: Avg: Primary Articles: Minerals: Metallic	5

83	WPI: Avg: Primary Articles: Minerals: Others	5
84	WPI: Avg: Fuel, Power, Light & Lubricants: Coal Mining (CM)	5
85	WPI: Avg: Fuel, Power, Light & Lubricants: Minerals Oils (MO)	5
86	WPI: Avg: Fuel, Power, Light & Lubricants: Electricity	5
87	WPI: Avg: Mfg: Food: Dairy Products	5
88	WPI: Avg: Mfg: Food: Canning, Preserving & Processing of Fish (CP)	5
89	WPI: Avg: Mfg: Food: Grain Mill Products	5
90	WPI: Avg: Mfg: Food: Bakery Products	5
91	WPI: Avg: Mfg: Food: Sugar, Khandasri and Gur	5
92	WPI: Avg: Mfg: Food: Common Salts	5
93	WPI: Avg: Mfg: Food: Cocoa Chocolate Sugar & Confectionary (CC)	5
94	WPI: Avg: Mfg: Food: Edible Oils	5
95	WPI: Avg: Mfg: Food: Oil Cakes	5
96	WPI: Avg: Mfg: Food: Tea and Coffee	5
97	WPI: Avg: Mfg: Food: Others	5
98	WPI: Avg: Mfg: Beverages, Tobacco & Tobacco Product (BT)	5
99	WPI: Avg: Mfg: Textiles: Cotton	5
100	WPI: Avg: Mfg: Textiles: Man Made	5
101	WPI: Avg: Mfg: Textiles: Woolen	5
102	WPI: Avg: Mfg: Textiles: Jute Hemp & Mesta	5
103	WPI: Avg: Mfg: Textiles: Others	5
104	WPI: Avg: Mfg: Wood & Wood Products	5
105	WPI: Avg: Mfg: PP: Paper and Pulp	5
106	WPI: Avg: Mfg: PP: Paper Board	5
107	WPI: Avg: Mfg: PP: Newspaper & Periodicals Prints	5
108	WPI: Avg: Mfg: Leather & Leather Products	5
109	WPI: Avg: Mfg: Rubber & Plastic: Tyres & Tubes	5
110	WPI: Avg: Mfg: Rubber & Plastic: Plastic	5
111	WPI: Avg: Mfg: Rubber & Plastic: Others	5
112	WPI: Avg: Mfg: Chemicals: Basic Heavy Inorganic Chemical (BH)	5
113	WPI: Avg: Mfg: Chemicals: Basic Heavy Organic Chemical (BO)	5
114	WPI: Avg: Mfg: Chemicals: Fertilizer and Pesticide (FP)	5
115	WPI: Avg: Mfg: Chemicals: Paints Varnishes & Lacquers (PV)	5
116	WPI: Avg: Mfg: Chemicals: Dyestuffs and Indigo	5
117	WPI: Avg: Mfg: Chemicals: Drugs and Medicines (DM)	5
118	WPI: Avg: Mfg: Chemicals: Perfumes, Cosmetics, Toiletries (PC)	5
119	WPI: Avg: Mfg: Chemicals: Turpentine, Synthetic Resins, etc (TS)	5
120	WPI: Avg: Mfg: Chemicals: Matches, Explosives and Others (ME)	5
121	WPI: Avg: Mfg: Non Metallic Mineral Products (NM)	5
122	WPI: Avg: Mfg: BM: Basic Metals and Alloys (MA)	5
123	WPI: Avg: Mfg: BM: Non Ferrous Metals	5
124	WPI: Avg: Mfg: BM: Metal Products	5
125	WPI: Avg: Mfg: Machinery: Non Electrical	5
126	WPI: Avg: Mfg: Machinery: Electrical: Industrial (IN)	5
127	WPI: Avg: Mfg: Machinery: Electrical: Wires and Cables (WC)	5
128	WPI: Avg: Mfg: Machinery: Electrical: Dry & Wet Batteries	5
129	WPI: Avg: Mfg: Machinery: Electrical: Apparatus & Appliances (EA)	5
130	WPI: Avg: Mfg: Transport Equipment: Locomotives, Railway Wagon (LR)	5

131 WPI: Avg: Mfg: Transport Equip: Motor Vehicles and Others (M 5